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ABSTRACT

Video conferencing for use in education has included the development of expensive yet sophisticated technology capable of delivering quality instruction to multiple sites. Limitations arise from using a closed network; factors such as cost to establish and operate the network with video compression or satellite technology can potentially affect programming. Desktop video conferencing is an alternative to expensive and site-restricted technologies. This paper reviews the process that is involved in selecting desktop video conferencing as the "next generation" distance learning technology. In addition, the paper discusses the creation of a multi-site desktop video conferencing network designed to serve central Louisiana and provide an array of program possibilities including courses for credit, teacher, certification, and training to participating sites. The desktop video conferencing system at Northwestern State University (Louisiana) is highlighted. (Contains 13 references.) (Author/MES)

Linking Video Conferencing to the Desktop

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Abstract: Video conferencing for use in education has included the development of expensive yet sophisticated technology capable of delivering quality instruction to multiple sites. Limitations arise from using a closed network and a factor such as cost to establish and operate the network with video compression or satellite technology can potentially impact programming. An alternative to expensive and site-restricted technologies is desktop video conferencing. This paper reviews the process that involved selecting desktop video conferencing as the "next generation" distance learning technology. In addition, the paper discusses the creation of a multi-site desktop video conferencing network designed to serve central Louisiana and provide an array of program possibilities including courses for credit, teacher certification, and training to participating sites.

Introduction

The evolution of video conferencing for applications in education has accelerated significantly. Moreover, desktop video conferencing systems are becoming viable options to more expensive video compression systems for delivering classes (Kies, Williges and Rosson, 1997). Prevailing distance-learning technologies such as interactive satellite, video compression, audio graphics, and web-based Internet classes have a history of providing a mechanism to facilitate classes for credit or training to specific sites. What has resulted from the use of these technologies is an awareness of and sensitivity to the cost of delivering programming at a distance. With other considerations such as student attitude toward the technologies, interaction with the teacher and students, availability of access to the technology and support resources and adaptability of the technology to specific learning styles of the participants, a new desktop distance learning system emerged as a possible contender in the arena of diverse and costly distance learning technologies.

Desktop Video Conferencing as an Emerging Distance Learning Technology

The literature suggests that technologies such as desktop video conferencing have positively impacted the quality of teaching and availability of electronic resources for students (Googin, Finkenberg and Morrow, 1997). Desktop video conferencing is a relatively new yet emerging technology that provides cost-effective instruction under the umbrella of distance learning. Specifically, the cost of delivering instruction via distance learning using computer software and teleconferencing strategies--the profile of desktop video conferencing--creates savings in terms of money, time and resources without a substantial loss of effectiveness of instruction (Castellan, 1993). Desktop video conferencing has created more practical, less network specific distance learning opportunities than systems like video compression that cost $250,000 to $300,000 (Ward and Lee, 1995). It is a technology that allows students, teachers and colleagues to interact with each other from their desks or classrooms via the Internet creating the essence of a phone conversation but with video and graphics (Googin, Finkenberg and Morrow, 1997).

Technologies such as desktop video conferencing are often evaluated by specific benefits they generate that support instruction particularly for distance learning applications. Since most distance learning technologies improve access to learning, especially for students who are time and place bound, other issues such as creating positive learning environments for users are equally important. Laney (1996) noted that desktop video conferencing may foster collaborative teaching and learning environments between universities and public school districts or between rural and urban schools. Other benefits of using desktop video conferencing include sharing courses and expertise in the field with other institutions with limited resources and providing opportunities for students to participate in "electronic fieldtrips" where they meet with experts in their respective fields (Googin, Finkenberg and Morrow, 1997). Regarding the benefits of using desktop video conferencing over other distance learning technologies such as satellite or compressed video technologies, the information by Evans (1997) summarizes a comparison between the three technologies when examined by attributes such as coverage, interactivity, quality of video, cost of technology, cost-effectiveness, production and preparation, access to the technology and infrastructure.

	Desktop Video Conferencing	*Satellite*	*Compressed Video*
Coverage	limited number of sites	large number of sites	limited number of sites
Interactivity	face-to-face and maximized	limited interaction	face-to-face
Video Quality	lower resolution, less than full motion video	broadcast quality full motion video	lower resolution, less than full motion video
Costs	monthly lines costs for ISDN (competitively priced)	leased T-1 lines (usually expensive)	brokered satellite time (usually expensive)
Cost-effectiveness	most cost-effective of three technologies	cost-effective for large audiences	more cost-effective than satellite
Production	in an informal atmosphere or office at the desktop	usually in a studio	usually in a classroom
Access	connection made via a computer	uplinking by an video engineer	connection made via a technician
Infrastructure	ISDN phone lines	uplink transmitter	T-1 lines in designated markets

Table 1: Summary by Evans (1997) of comparison between three distance learning technologies, desktop video conferencing, satellite and video compression

There are some disadvantages however, to delivering courses at a distance using desktop video conferencing. Video and audio quality will not be as good as broadcast television or video compression. Video and audio use a great deal of space called brandwidth, which is typically not available with desktop video conferencing technologies (Googin, Finkenberg and Morrow, 1997). Comments such as "This would be great if...the video were better...the audio were better...it could mutli-point...the screen was bigger" (Johnson, 1999, p.1) are typical comments from users of first generation desktop video conferencing technologies. Additionally, users may have difficulty adjusting to live audio and video while trying to

manipulate the technology like microphones and cameras to obtain optimal operating quality (Ward and Lee, 1995). Training of users may become the element that eventually neutralizes any disadvantages of using desktop video conferencing for distance learning applications.

Kinds of Desktop Video Conferencing Technologies

The first and most recognizable type of desktop video conferencing system is CU-SeeMe, developed at Cornell University (Fudell, Hardy and Terrell, 1997). CU-SeeMe allows students to send and receive video and audio on a computer to other participants (Todd, 1996). Companies like Vtel and PictureTel have developed desktop video conferencing systems using ProShare operating software (Johnson, 1999). Recent entries into operating software include Ilinc Corporation's Learnlinc Version 3.1 which is the system running the desktop video conferencing network at Northwestern State University, the subject of this paper.

Evaluation of Desktop Video Conferencing Technologies

A sizeable body of research exists that evaluates distance-learning systems (Goldstein, 1993). Yet the majority of research has focused on evaluating high-quality video systems operating on broad bandwidth. Limited research is available on low-bandwidth systems such as desktop video conferencing. This is due in part to how new the technology is and its limited application, thus far, in education. A study by Biner, et al (1995) examined student performance and satisfaction with low-bandwidth modalities. It revealed that technology-related factors such as quality of video and audio and the impact of conferencing tools like the electronic whiteboard are important components to the success of student performance and satisfaction with the technology. Kies, Williges and Rosson (1997) examined specific factors that affect quality of presentation such as frame rates and resolution of image. They noted that a minimum acceptable range of tolerance for users was 5-6 frames per second although a full 30 frames per second is desirable. Systems like CU-SeeMe operate with fewer frames rates to run at lower bandwidths on ISDN lines. The results of performance on slower frame rates had no effect on quiz scores. Also, transmitting video images over lower bandwidth did not affect a learner's ability to absorb educational material. The authors of the study said, "Equally important is the implication that expensive hardware and software is not needed for the transmission of video to ensure learning" (Kies, Williges and Rosson, 1997, p. 84). The study noted eight recommendations for using desktop video conferencing systems in distance learning: (1) avoid frame rates less than 6 fps; (2) avoid lines of resolution less than 320 X 240; (3) if considerable motion is required, use a faster frame rate; (4) if considerable detail is needed, use higher resolution: (5) use a whiteboard for lecture notes; (6) ensure high-quality audio; (7) be sensitive to student dissatisfaction with the technology; and (8) support interactivity by creating a comfortable setting (Kies, Williges and Rosson, 1997).

Desktop Video Conferencing as the Next Generation Distance Learning System

Northwestern State University of Louisiana has pioneered the use of distance learning in Louisiana. Even though the history of this endeavor is predated to the late 50's when the university produced the first ITV (Instructional Television) project in the state, the university has developed and used several distance learning delivery systems including audio graphics, interactive satellite, web-based Internet and video compression technologies. While distance learning technologies possess unique qualities that make them desirable for special applications, most have weaknesses that limit their use. Moreover, the technologies that provide elements most desired by students are usually too expensive and restrictive. Consequently, the university as a result of a U.S. Department of Agriculture Rural Utilities Service grant decided to pursue a new direction in distance learning which is flexible, accommodates for most learning styles, and is synchronous but can have asynchronous applications. It also has multiple applications that replicate traditional face-to-face instruction, can access educational resources such as the World Wide Web, presentation software, video and CD technologies yet has a "price tag" that is affordable.

The challenge for the university was to select a technology that could be used in several instructional applications yet provide participating sites an opportunity to have a technology that also doubles as a powerful PC lab for training disadvantaged citizens in 10 rural parishes of central Louisiana. In effect, the network had to make available traditional courses for college credit and teacher certification, provide training for projects like "Welfare to Work" and others where people receive training on how to use computers in the workplace, and be connected to the global Internet/World Wide Web. This was a tall order for one technology, and especially a technology that anchors a multi-purpose distance-learning network. Desktop video conferencing was selected because it met all the criteria established in the grant and of course by the users who needed a cadre of services.

This desktop video conferencing network was the answer to several problems that faced the university. First, it introduced a new technology that addresses several distance learning challenges such as the need to see faces of teachers and students. Second, it provided a network where partnerships were established not out of need but necessity. Third, it allows courses for credit to be taught from any discipline without restrictions or limitations imposed by the technology. Fourth, it provides at least one site per parish where students, teachers and citizens can come together and take classes or participate in training sessions. Fifth, it affords teachers who have skills unique to a discipline, to teach classes to other students in the parish and across the state using their expertise. Sixth, it serves as a PC lab at the site and can be used for regular computer activities; not so with dedicated video compression classrooms and satellite studios. And seventh, it provides a low-cost alternative to video compression technology particularly since video compression sites were not located at public schools.

Even though Northwestern State University has in operation four distance learning systems, interactive satellite (limited because of cost), web-based courses on the Internet, video compression and desktop video conferencing it has made a commitment to this new technology and according to the desktop video software provider is the first university in the south to proffer a network like this. Collaboration within the university has expanded opportunities with desktop video conferencing. Another grant has been secured to establish a training facility for the College of Education to allow teachers to develop courseware using this technology and originate classes in graduate and undergraduate education from this site. This new lab will virtually double the teaching capabilities not only in kinds of courses but number of sections as well. The teaching stations have increased from four to fifteen. While the bandwidth needed to operate the system will limit the number of classes taught simultaneously, there will be adequate preparation stations available for teachers to prepare their classes in advance. Therefore, scheduling of classes, workshops or training sessions should be simple without sacrificing time for faculty to prepare; a problem that plagues many distance learning providers. Educational Technology in the College of Education will use desktop video conferencing to develop "hands-on" technology training, which until now has been limited, by most distance learning technologies. In effect, the faculty believes that most of the future movement in distance learning will be toward low-cost, web-based instruction on the desktop.

Funding for Desktop Video Conferencing

The initial funding for the desktop video conferencing system at Northwestern State University was supplied from a grant written to the United States Department of Agriculture Rural Utilities Service in August 1997. A second grant was submitted a year later to broaden the scope of the project to include five additional parishes in central Louisiana. The College of Education was awarded a grant in 1998 to parallel the RUS project, which would essentially double the teaching and production capabilities by establishing a second desktop video conferencing laboratory on campus, but in the Teacher Education Center.

The RUS project established a distance learning facility in ten parishes to address economic and educational challenges for the people of this predominantly rural area. These include: (1) K-12 education--standard, remedial and advanced placement; (2) higher education--undergraduate, graduate, and teacher certification; (3) adult and continuing education--GED, workforce development, and life-long learning; and (4) job searching. College-level courses were planned for the network and made available to those who are time and place bound with specific restrictions that limit their ability to take classes or attend workforce training sessions. Job training and information will also be available for those making transition from welfare to work. Public school administrators will use the system to collaborate on other initiatives by face-to-face

conferencing. The match for the project was 60 percent from the partnering institutions and 40 percent from the Department of Agriculture Rural Utilities Service.

The impetus for the grant was to address problems that faced the available user population from demographic data that include a rural population with a high drop-out rate of 50% to the ninth grade, 91% do not have college degrees, a large percentage of the population are classified as disadvantaged, and of those who attend college over 50% need remediation.

A second grant from the Board of Regents Support Fund, State of Louisiana, specifically addressed the need to prepare teachers for the emerging technologies such as desktop video conferencing. The College of Education at Northwestern State University is a leader and advocate of distance learning. The grant provided the tools for training per-service and in-service teachers and administrators to use these new tools. Area superintendents expressed a concern about the infusion of technology without proper training for teachers on how to use and integrate technology into teaching and learning. They were worried the problem may compound an already desperate situation regarding the attitude of teachers and parents about technology in the classroom. What resulted from these grants was the establishment of a network that accommodates a multitude of educational and work related issues while helping to better prepare teachers for using technology in the classroom.

The Desktop Video Conferencing System at Northwestern State University

The desktop video conferencing system at Northwestern State University joins other distance learning technologies on campus as the "next generation" of distance learning technologies. The projects valued at almost $700,000 impact residents of ten parishes in central Louisiana and teachers and school systems from throughout the state. It currently provides several undergraduate and graduate classes to rural parishes with several of those participants enrolled in classes for certification. Plans are underway to provide training to area teachers on technology use through courses and workshops. The system is user-friendly and accommodates the diverse schedules of students located across the area. And, when not in use as a distance-learning network it serves as a state-of-the-art computer lab for word processing, web searching, making power point presentations as well as other computer-related activities. These are ancillary services, of course, that most distance learning technologies cannot provide. Moreover, distance-learning technologies use fixed networks with dedicated classrooms and are usually not available as a technology support area.

A profile of the network is as follows. First, on campus there are two teaching areas on opposite ends of campus. One serves as a teacher and preparation site with four desktops while the other is a teaching/preparation and computer laboratory with 15 desktops that can also be used as a receive site. The sites are connected via T-1 lines to a server on campus then to the ten sites in the parishes. Second, each school site has ten computers configured in the lab with desktop software, camera and audio/microphone headset. The capacity of the system is three classes simultaneously. This means that at one site up to three classes could be received in one time block. Classes are currently offered starting at 4 PM and again at 7 PM if necessary. During the evening hours it is possible to provide six different classes per night or at least 24 from Monday to Thursday.

Ilinc Corporation provides the operating software for the network. The Learnlinc Version 3.1 software has a teacher or client area with conferencing window, class list, agenda list, and text chat area. Participants have a similar student area but without features that control the system. Learnlinc includes complete administration tools to register and keep records on students. It has a question and answer application, whiteboard, synchronized web browser and can use virtually any authoring tool. The Q & A application can be prepared prior to class and is a powerful device to check to see if students are grasping concepts being discussed in class. It is good for quizzes as well but has limitations as to how many questions can be asked. The Q & A application will report the results numerically or with a graph to the professor and students as desired. The system can promote interaction through "hand-raising." For example, if the professor asks a general yes or no question and seeks a yes response. Students click their "hand" icon. The teacher sees the hand appear next to the student's name on the roster. It is also a device to use when a student has a question. Control of the conferencing window can be passed to another student where his/her image in the conferencing window is transmitted to the entire class. Students may not pass control of the conferencing window but can do most other applications. The software works very well on T-1 lines but can work at lesser bandwidths.

While it is possible for all sites (100 students) to be enrolled in the same class, distance-learning protocol suggests that a class be no larger than a normal face-to-face class, which is about 30 students.

Desktop video conferencing, the RUS system at Northwestern State University, will compete with some successful distance learning technologies and initiatives already in operation on campus. Even though the network is in its first full year of operation it has already shown signs that it can provide high-quality cost-effective instruction that is meaningful, accommodating and user-friendly. As the group of users of distance learning technologies continues to diversify desktop video conferencing will continue to meet the demand.

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